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Forest Service

United States Department of Agriculture

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Red Alder

An American Wood

Red alder is the most common hardwood in the Pacific Northwest and the largest of the American alders. It is a fast-growing, pioneer species and has nitrogen-fixing nodules on its roots. The wood is diffuse-porous, moderately light, and soft. It has excellent turning and polishing characteristics and takes glue, paint, and stain well. Major uses are for furniture, cabinets, and pallets, but substantial amounts are also used to make paper.

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Red Alder
(*Alnus rubra* Bong.)

Constance A. Harrington[1]

Distribution

The range of red alder extends from southern California (latitude 34° N.) to southeastern Alaska (60° N.) (fig. 1). Red alder is not commonly found east of the Cascade or Sierra Nevada Ranges, although there are several isolated populations in northern Idaho. The species develops best at low elevations (below 1,500 ft) in northern Oregon, Washington, and British Columbia. In the central part of its range, scattered trees occur as high as 3,300 feet, but most stands are below 2,500 feet.

Red alder grows in humid or superhumid climatic conditions. Throughout the tree's range, annual precipitation varies from 16 to 220 inches, with most falling as rain during winter. Low winter temperatures and lack of precipitation during the growing season appear to be the main limits to the range of the species. For good tree development, annual precipitation should exceed 25 inches, or tree roots should have access to ground water.

The best stands grow on deep, well-drained loams or sandy loams of alluvial or volcanic origin. Red alder tolerates poorly drained conditions and some flooding during the growing season; consequently, stands on wet or poorly drained soils are common. It often occurs as a component of mixed stands that include Douglas-fir (*Pseudotsuga menziesii*), western hemlock (*Tsuga heterophylla*), western redcedar (*Thuja plicata*), grand fir (*Abies grandis*), black cottonwood (*Populus trichocarpa*), bigleaf maple (*Acer macrophyllum*), and willow (*Salix*).

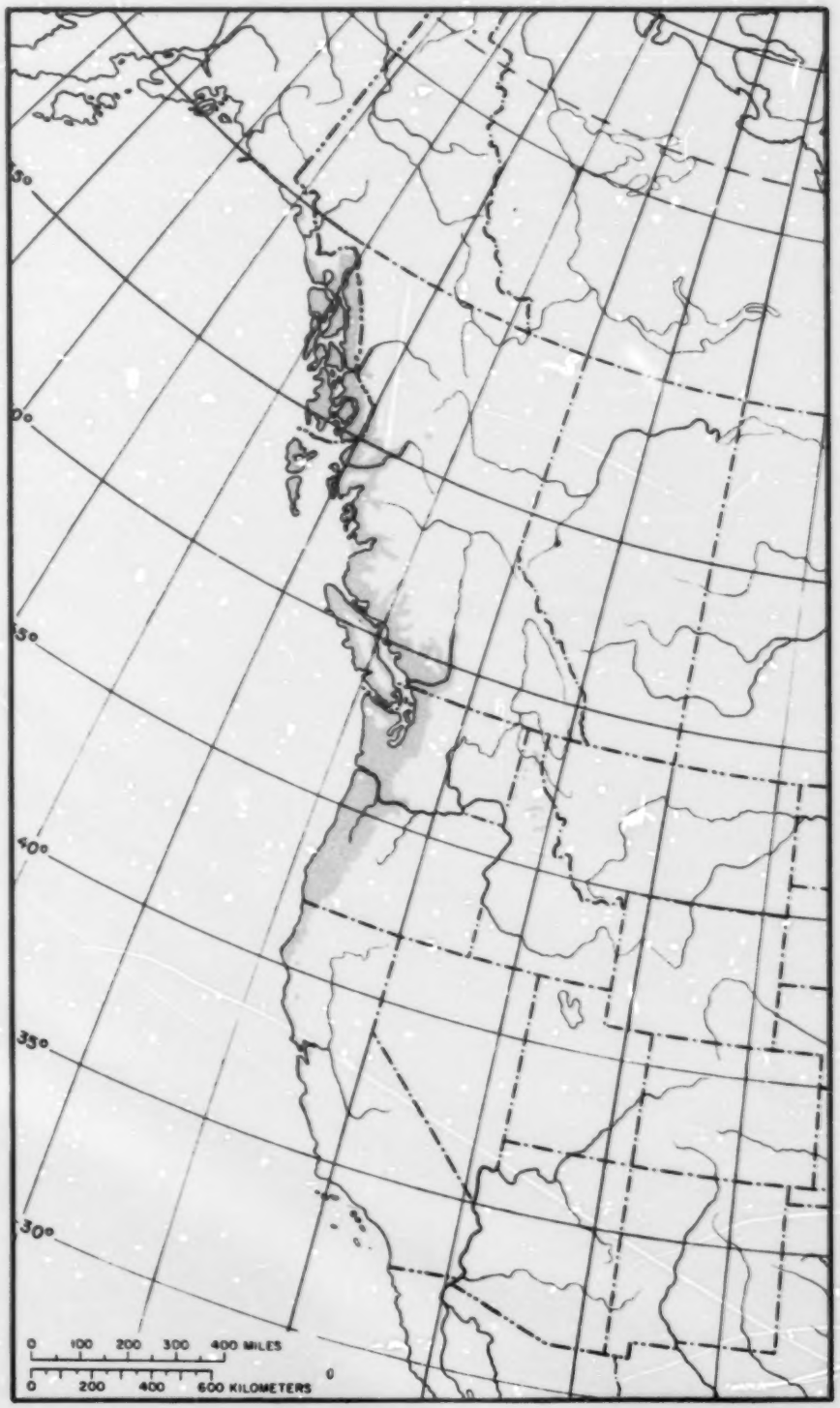

Figure 1—Natural range of red alder. F-532737

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Description and Growth

On good sites, red alder can attain heights of 100 to 130 feet and diameters of 22 to 30 inches. In closed stands, the trees typically have clear, slightly tapered boles and narrow, domelike crowns. The light-gray bark is thin and smooth. Red alder forms extensive, fibrous root systems. The roots have numerous nitrogen-fixing nodules, which are a symbiotic association between the tree and beneficial bacteria belonging to the genus *Frankia*. The leaves are dark green and oval or elliptic, with both coarse and fine teeth. They generally range from 2 to 6 inches long (fig. 2).

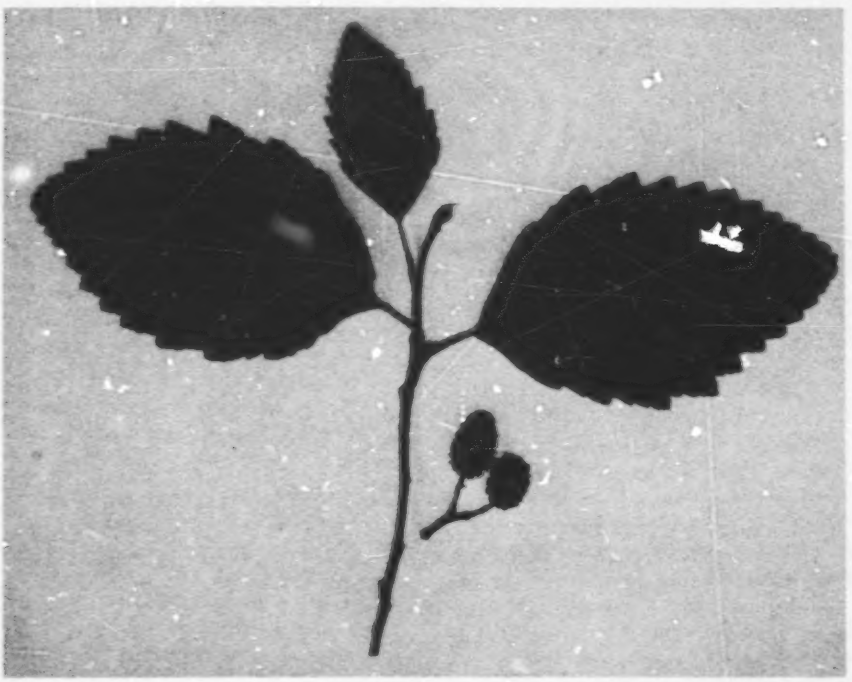

Figure 2—Red alder: leaves and conelike strobiles. F-532727

Red alder is a prolific and consistent seed producer. Moderate seed crops are produced almost annually, with bumper crops occurring every 3 to 5 years. The seeds are small, light, winged nuts. There are 23,000 to 86,000 seeds per ounce, and wind dissemination is quite effective. The seeds are borne in small, woody, conelike strobiles 0.4 to 1.3 inches long and 0.3 to 0.6 inch wide. Most of the seed is shed in late fall and early winter.

Seed germination and seedling growth is best on moist mineral soil with full sunlight. The species is an aggressive pioneer on avalanche paths, road cuts, log landings, skid trails, and other areas where mineral soil has been freshly exposed. Clearcutting and large group selection are the most reasonable regeneration systems. Young red alder sprouts prolifically when cut; however, coppice regeneration is not likely when trees of pole- or saw-log size are harvested.

Height growth of young red alder seedlings is exceptionally rapid. On favorable sites, they can grow 3 feet or more the first year; and on all but the poorest sites, they pass breast height (4.5 ft) the second year. Maximum height growth is usually from 2 to 5 years, but is still excellent after that age. On the best sites, trees can be taller than 30 feet at age 5, 50 feet at age 10, and 75 feet at age 20.

Red alder is a relatively short-lived species. It matures at about 60 to 70 years of age and maximum age is about 100 years. Maximum cubic volume of about 7,500 cubic feet per acre is attained at age 50 to 70 years in pure stands. Most of the alder volume, however, is in mixed stands where growth and yield are quite variable.

Red alder is fairly free of insect and disease problems, especially when young (up to age 40 or 50) and uninjured. *Fomes igniarius*, a white heart rot, is probably the major cause of cull in older trees. Insect pests are not usually a major concern, but serious outbreaks of tent caterpillars (*Malacosoma disstria* and *M. californicum*), sawflies (*Eriocampa ovata* and *Hemichroa crocea*), and flea beetles (*Altica ambiens* and *Pyrrhalta punctipennis*) can cause substantial growth reduction.

Animal damage is not usually a problem in red alder stands. Occasional browsing by black-tailed deer (*Odocoileus hemionus columbianus*), girdling of small stems by mountain beaver (*Aplodontia rufa*) or meadow mice (*Microtus* spp.), and bole damage by sapsuckers (*Sphyrapicus varius*) have been observed.

Climatic factors can damage red alder. Mortality and top damage may occur after ice storms or unseasonable frosts. Fire is rare because flammable debris is scarce in most red alder stands. Windthrow is not common in forest stands; however, trees can be blown over along cutting boundaries or where established root systems have been undercut by flooding or erosion.

The commercial value of red alder has traditionally been lower than that of its associated conifers; consequently, most forest managers have tried to eliminate alder from conifer stands. However, recent increases in the value of red alder

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wood and new appreciation of the species' ability to add nitrogen and organic matter to the soil have resulted in greater interest in managing alder.

Common Names

The species is most commonly called red alder, western alder, or just alder. Other names used, particularly in the past, are Oregon alder and Pacific coast alder.

Related Commercial Species

Red alder is usually marketed by itself. Some forest inventory figures group the Pacific coast hardwoods. Although red alder is the primary species, black cottonwood, bigleaf maple, Oregon ash (*Fraxinus latifolia*), and varieties of paper birch (*Betula papyrifera*) are sometimes included in figures for western Washington and Oregon; black cottonwood, paper birch varieties, balsam poplar (*Populus balsamifera*), and quaking aspen (*Populus tremuloides*) are sometimes included in figures for coastal Alaska.

Supply

The total volume of red alder growing stock in the United States in 1977 was 7.0 billion cubic feet. Net volume of U.S. sawtimber (trees 11 inches in diameter or greater) was 21.6 billion board feet, International 1/4-inch rule. Over 97 percent of the sawtimber volume is in western Washington and Oregon; only minor amounts exist in southern Alaska and northern California.

Production

In 1907, when production of red alder lumber was first reported, 115,000 board feet was produced. For the next 20 years, production remained low. In the late 1920's, however, production increased; and from then until the early 1950's, it fluctuated around 20 million board feet. Since the early 1950's, lumber production has rapidly increased; in 1980, it was a little more than 200 million board feet.

Red alder has been used for pulpwood since the early 1950's. Although the amount used for pulpwood by both local and foreign mills has been increasing tremendously, there is a great deal of annual fluctuation in use. Both the demand and the price paid for alder chips follow irregular, boom-or-bust cycles. Most of the fluctuation is caused by changes in the availability of conifer chips, and this is closely tied to the market for structural materials.

When conifer chips become less available, more red alder chips are used. This substantially affects the amount of red alder that is harvested and chipped. Foreign markets for red alder have been large, but generally erratic and short lived. In 1980, well over half the alder that was chipped was exported to Japan and Korea. Use of red alder for pulping is expected to increase; however, annual production figures will probably remain erratic.

Recently, a small, but increasing, amount of red alder has been used for plywood and veneer. In 1980, about 12 million board feet was used by the veneer industries in Washington and Oregon.

The amount of red alder used for fuelwood has increased markedly in recent years. However, the amount is difficult to quantify because most of it is harvested for personal use. Expanded use as a fuelwood for power generation is being considered.

Although use of red alder has increased many fold in the last 30 years, current production is still substantially below the current growth rate, and supplies are adequate for additional utilization of red alder.

Characteristics and Properties

Red alder wood is almost white when freshly cut but quickly changes to a light tan or light brown with a yellow or reddish tinge when exposed to the air. Heartwood is formed only in trees of advanced age, and there is no visible boundary between heartwood and sapwood.

Red alder wood is classified as diffuse-porous, which means that the pores in the wood do not vary much in size with changes in seasonal growth rates. The pores are fairly small and hard to see without magnification (fig. 3). The wood has two types of rays: narrow or simple rays, which are closely spaced and not visible without a hand lens, and broad or aggregate rays, which occur at irregular and often wide intervals. The annual growth rings include a wide band of earlywood (wood formed at the beginning of the growing season) and a comparatively narrow band of latewood. The rings can be difficult to distinguish in very fresh wood, but usually become more distinct with exposure to air, when the latewood becomes visible as fine brown or reddish brown lines. Red alder has fine, uniform, straight grain and very smooth texture. When the aggregate rays are present in a piece of wood, they form an attractive pattern; however, because the aggregate rays are irregularly distributed, the pattern is not regular or consistent.

The wood is moderately light and soft. Specific gravity (about 0.37 green volume, ovendry weight) or density (about 26 pounds per cubic foot at 12 percent moisture content) varies substantially between and within individual trees, but is not closely associated with tree age, distance from the pith, growth rate, or geographic location. Based on the density of the wood, its physical and mechanical properties are comparable to those of other species, such as quaking aspen and butternut (*Juglens cinerea*). It is rated low in shock resistance, however. Because

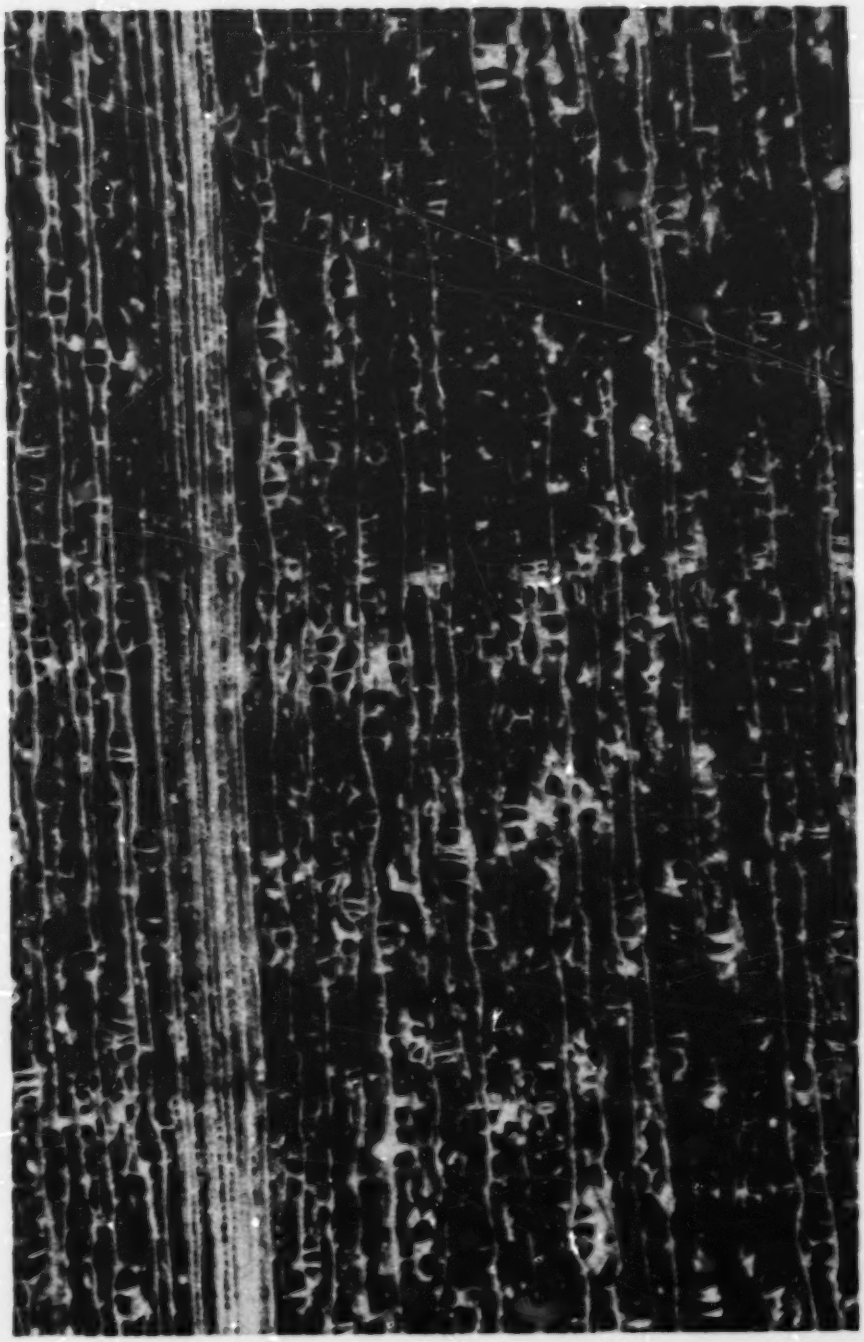

Figure 3—Wood of red alder magnified 15 times shows numerous small pores and simple rays, with an aggregate ray visible on the left. Photo by R. L. Krahmer, Oregon State University.

of its uniform texture, red alder is excellent for turning and polishing and takes glue, paint, and stain well. When properly seasoned, the wood is fairly stable in all dimensions and surface checking is not common.

Red alder is not a durable wood; it is considered nonresistant to decay. Logs should be processed quickly, particularly during warm weather, as decay proceeds rapidly. If processing must be delayed, the logs should be stored in water. Green lumber should be carefully stacked for air-drying or promptly kiln-dried to prevent damage from microbial stain.

Principal Uses

Nonstructural lumber is the major use of red alder, closely followed by chips for pulp and paper. Most of the lumber is used to produce furniture, cabinets, and pallets. In furniture and cabinets, red alder is used both alone and as backing for more expensive woods or as framing for upholstered pieces. Because of its light color, uniform texture, and ability to take stain well, the wood is frequently finished to imitate other species.

Chips may be converted to pulp by the kraft, acid sulfite, Permochem, and kraft green-liquor processes. Red alder pulp produces paper of good printability, smoothness, and softness. It is usually blended with conifer pulp in the manufacture of tissue, bond, envelope, and book papers. The kraft green-liquor process is used in the production of corrugated boxes.

Other uses include core stock or cross plies for plywood, interior finishing, industrial or domestic fuelwood, and charcoal. Small amounts are used to smoke-cure meat and fish. Residues are sometimes used for animal bedding or mulch, and the bark is used as a glue extender. Use for composite products such as waferboard is expected to increase.

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